4.0 Completing Risk/Hazard Quotient Calculations

IWAIR allows you to develop inhalation risk estimates for wastes of known chemical concentrations. Results from the risk calculation method include chemical-specific cancer risk estimates, total cancer risk estimates (i.e., the summation of the chemical-specific risk estimates), and chemical-specific noncancer risk estimates (i.e., HQs for noncarcinogens in the waste).[1]

IWAIR is structured in a stepwise framework. Through the use of a series of screens, IWAIR assists in selecting calculation options, identifying and entering required inputs, and generating desired outputs. There are four different pathways you can follow in performing a calculation:

- Pathway 1: Using CHEMDAT8 emission rates and ISCST3 default dispersion factors
- Pathway 2: Using CHEMDAT8 emission rates and user-specified dispersion factors
- Pathway 3: Using user-specified emission rates and ISCST3 default dispersion factors
- Pathway 4: Using user-specified emission rates and dispersion factors.

Guidance for determining which modeling pathway to follow is provided in Section 3.3. The stepwise approach employed by IWAIR to assist in calculating risk, whether you are following Pathway 1, 2, 3, or 4, is shown in Figures 4-1, 4-2, 4-3, and 4-4, respectively. The seven steps of the estimation process are shown down the right side of each figure, and the user input requirements are specified to the left of each step. The types of input data required will vary depending on the modeling pathway chosen. Screen-by-screen, IWAIR walks you through the steps of a risk calculation to arrive at inhalation risk estimates.

This section provides screen-by-screen guidance that describes the data that are required as input to each screen and the assumptions that are interwoven in the calculation being performed. The guidance provided in this section will assist you in completing a risk calculation. You will not need to reference all of the information provided in this section because the guidance addresses all four of the modeling pathways. Follow only those subsections that are applicable to your chosen pathway.

[1] Noncancer risks are not summed across chemicals, because summation is only appropriate when the same target organ is affected.

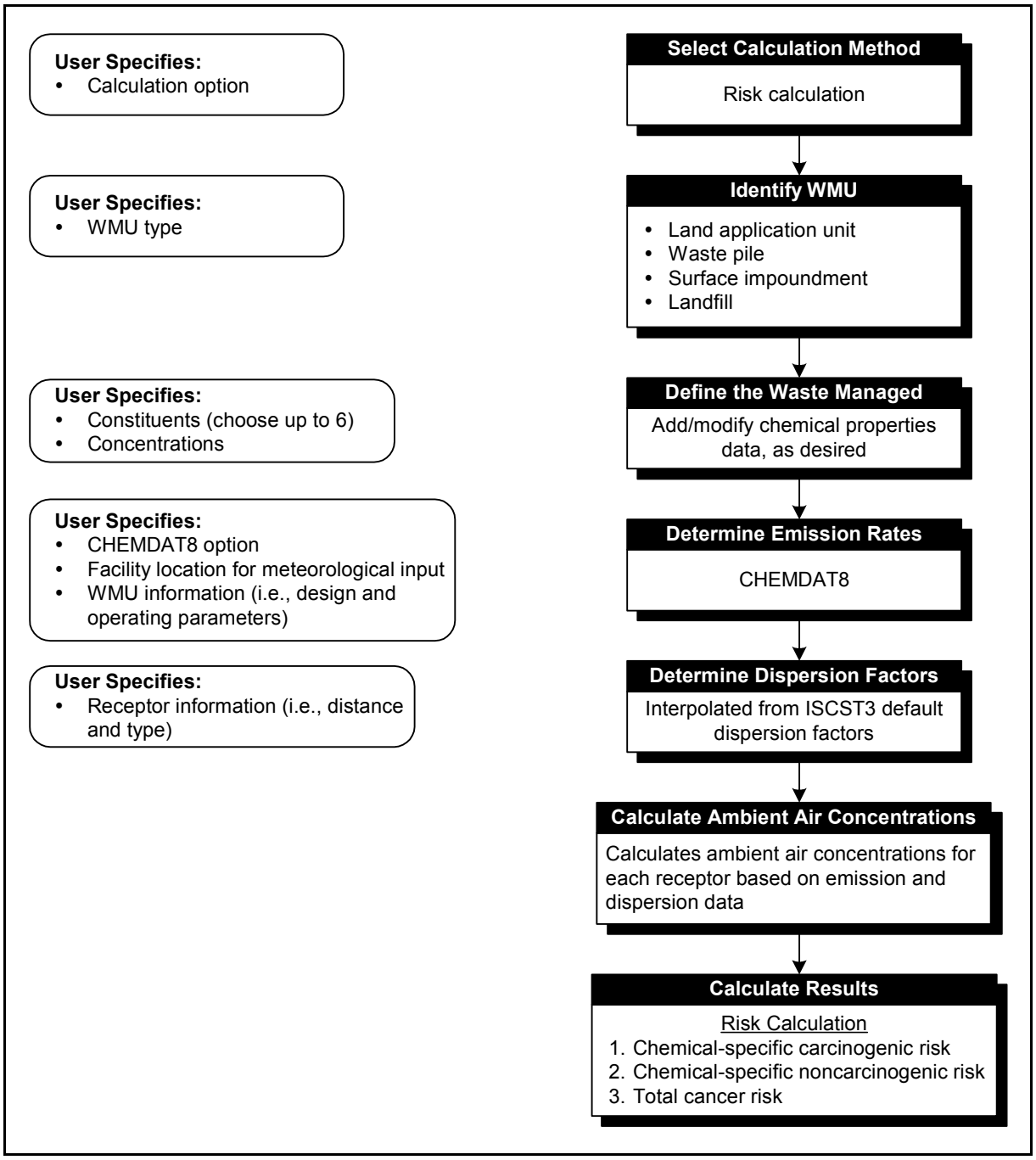


Figure 4-1. IWAIR approach for completing risk calculations, Pathway 1: Using CHEMDAT8 emission rates and ISCST3 default dispersion factors.

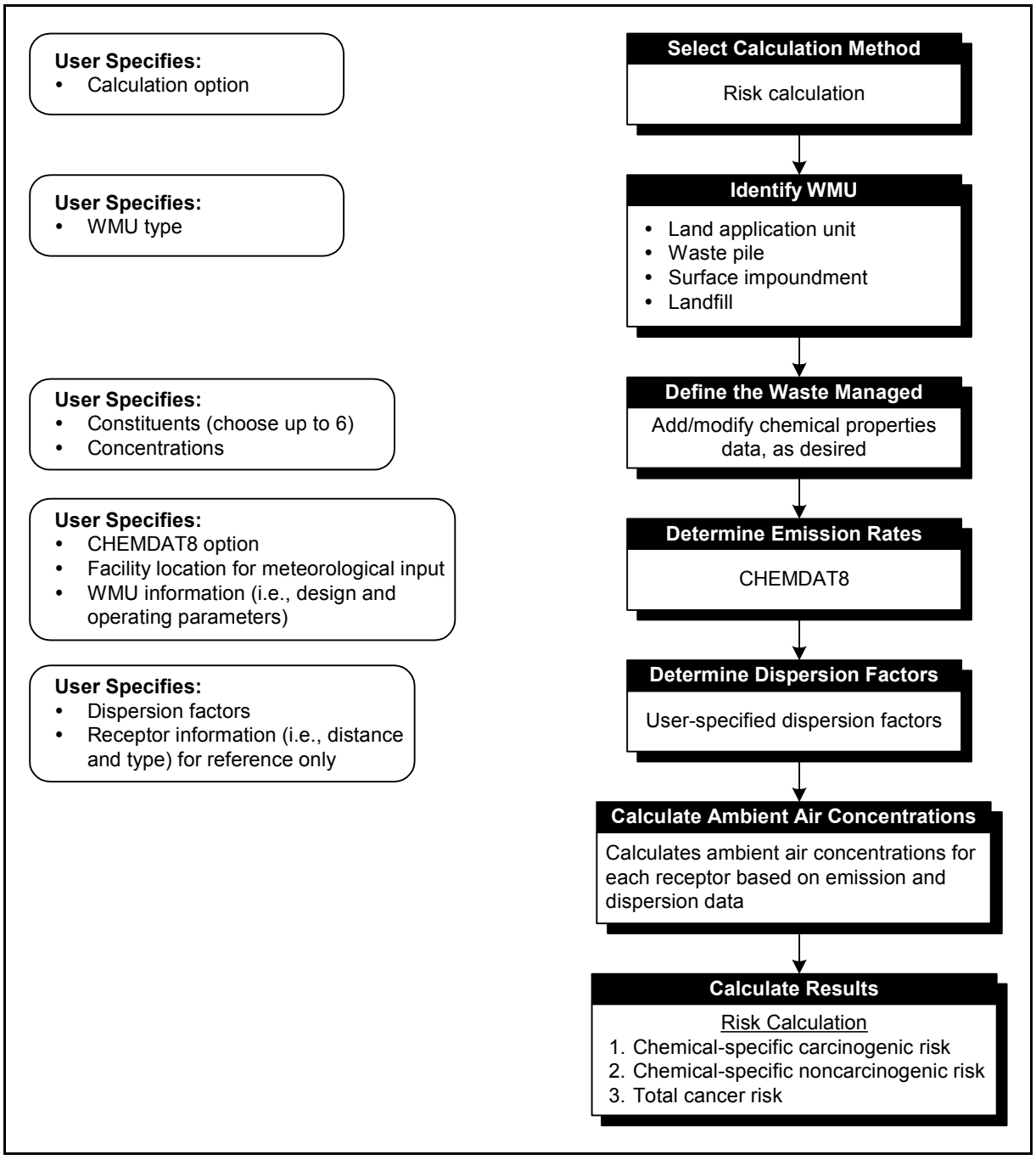


Figure 4-2. IWAIR approach for completing risk calculations, Pathway 2: Using CHEMDAT8 emission rates and user-specific dispersion factors.

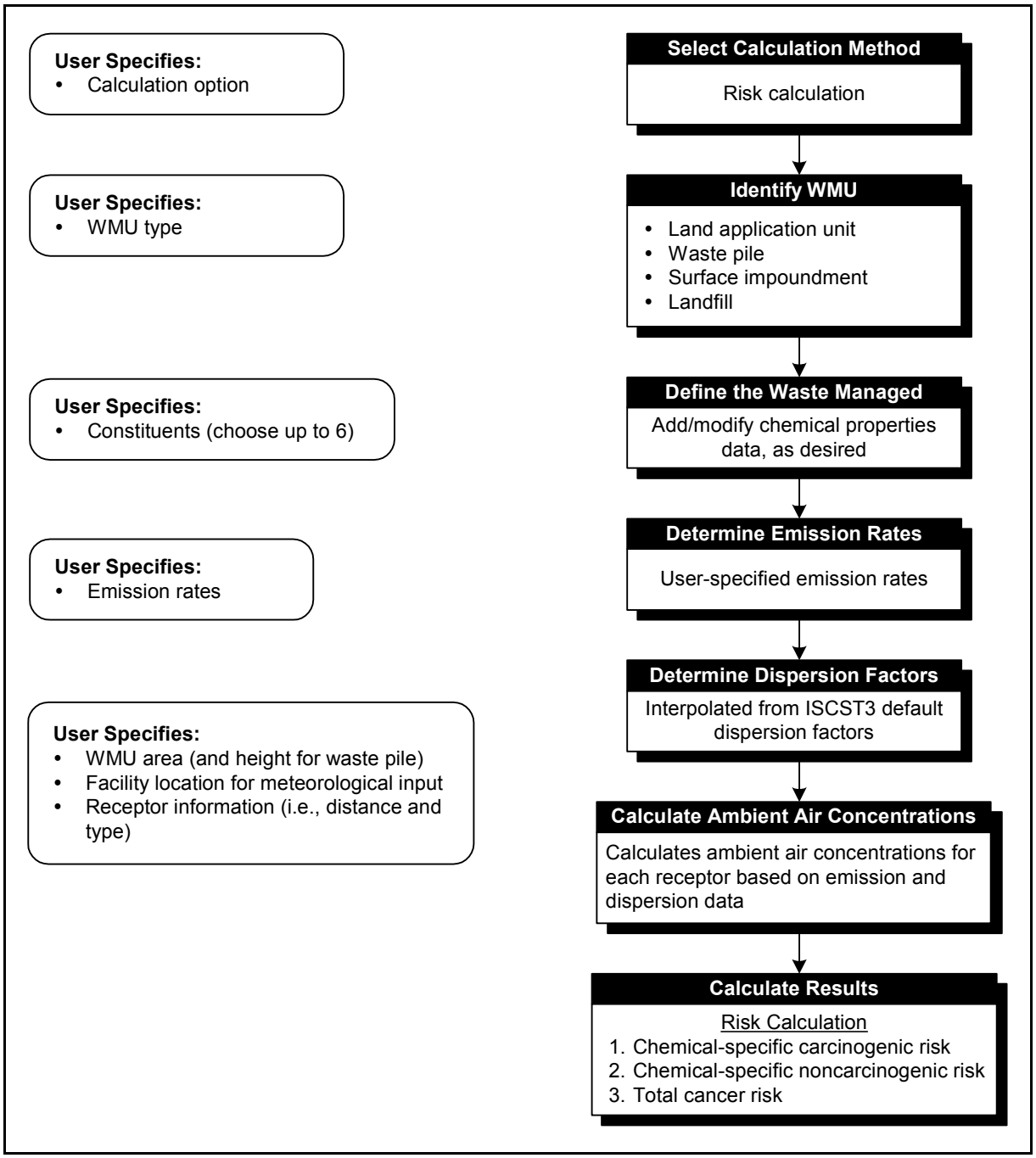


Figure 4-3. IWAIR approach for completing risk calculations, Pathway 3: Using user-specified emission rates and ISCST3 default dispersion factors.

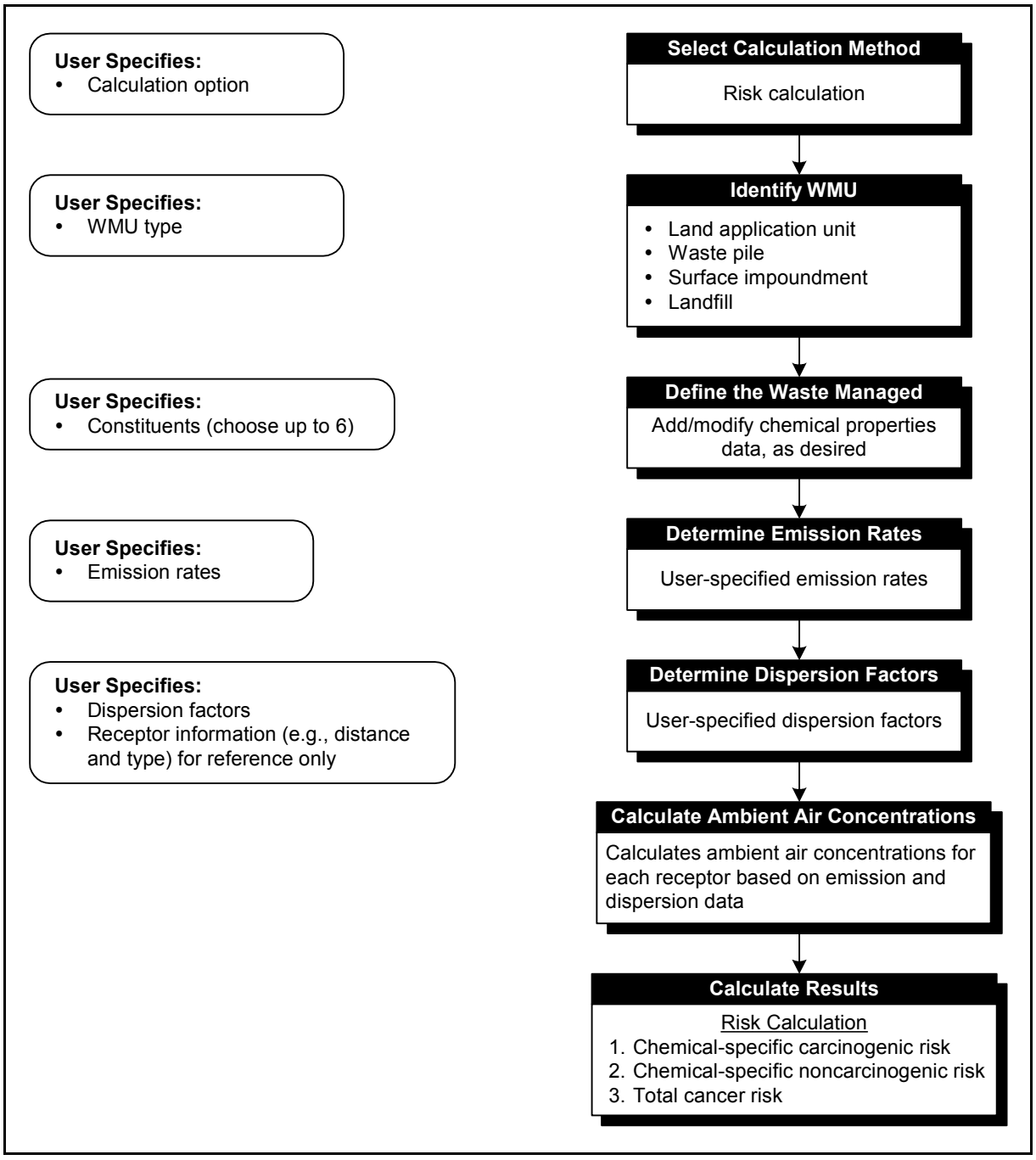
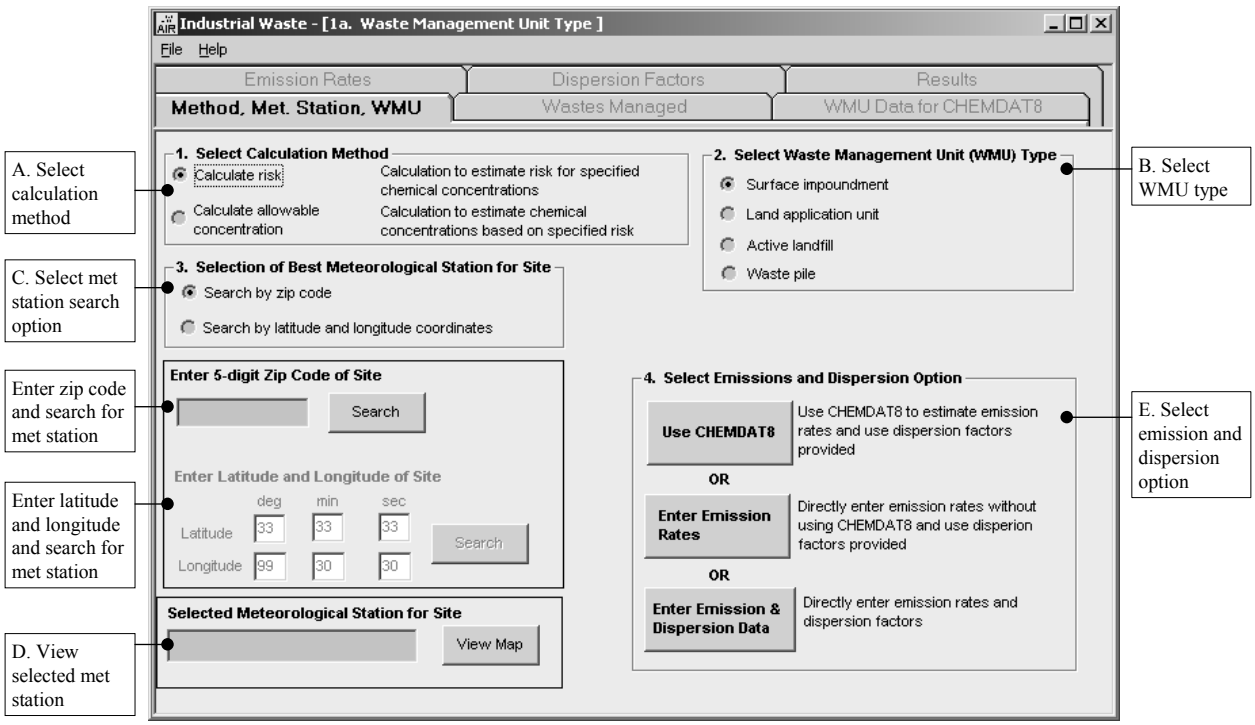


Figure 4-4. IWAIR approach for completing risk calculations, Pathway 4: Using user-specified emission rates and dispersion factors.



Screen 1A. Method, Meteorological Station, WMU

4.1 Method, Meteorological Station, WMU (Screen 1A)

A. Select Calculation Method (Screen 1A)

Select the calculation method by clicking on the |CALCULATE RISK| option button. Detailed guidance for selecting the appropriate mode of calculation is provided in Section 3.1.

B. Select Waste Management Unit (WMU) Type (Screen 1A)

Identify the WMUs that are used to manage wastes of concern at your facility and run the model separately for each unit type. The four unit types that are addressed as part of this guidance include surface impoundments (aerated and quiescent), active landfills, waste piles, and tilled land application units. A detailed description of these unit types is provided in Section 3.2. Select one of the four WMU types shown in Screen 1A by clicking on the appropriate option button.

C. Select Meteorological Station Search Option (Screen 1A)

The two search options available include searching by the site's 5-digit zip code or by its latitude and longitude. Select the appropriate search option and enter the appropriate information. This information is used to link the facility's location to one of the 60 IWAIR meteorological stations. The 60 stations cover the 48 contiguous states, Hawaii, Puerto Rico, and parts of Alaska. Data from the 60 stations (shown on maps in Screen 1B, viewed by clicking on

the |VIEW MAP| button shown on Screen 1A) were used as inputs to the air dispersion modeling effort conducted to develop the default dispersion factors contained in the IWAIR tool. They are also used as inputs to CHEMDAT8 emission modeling (e.g., temperature and wind speed). Additional information on this air dispersion modeling effort and the 60 representative meteorological stations is provided in Section 3.3.

Enter 5-Digit Zip Code and Search for Meteorological Station

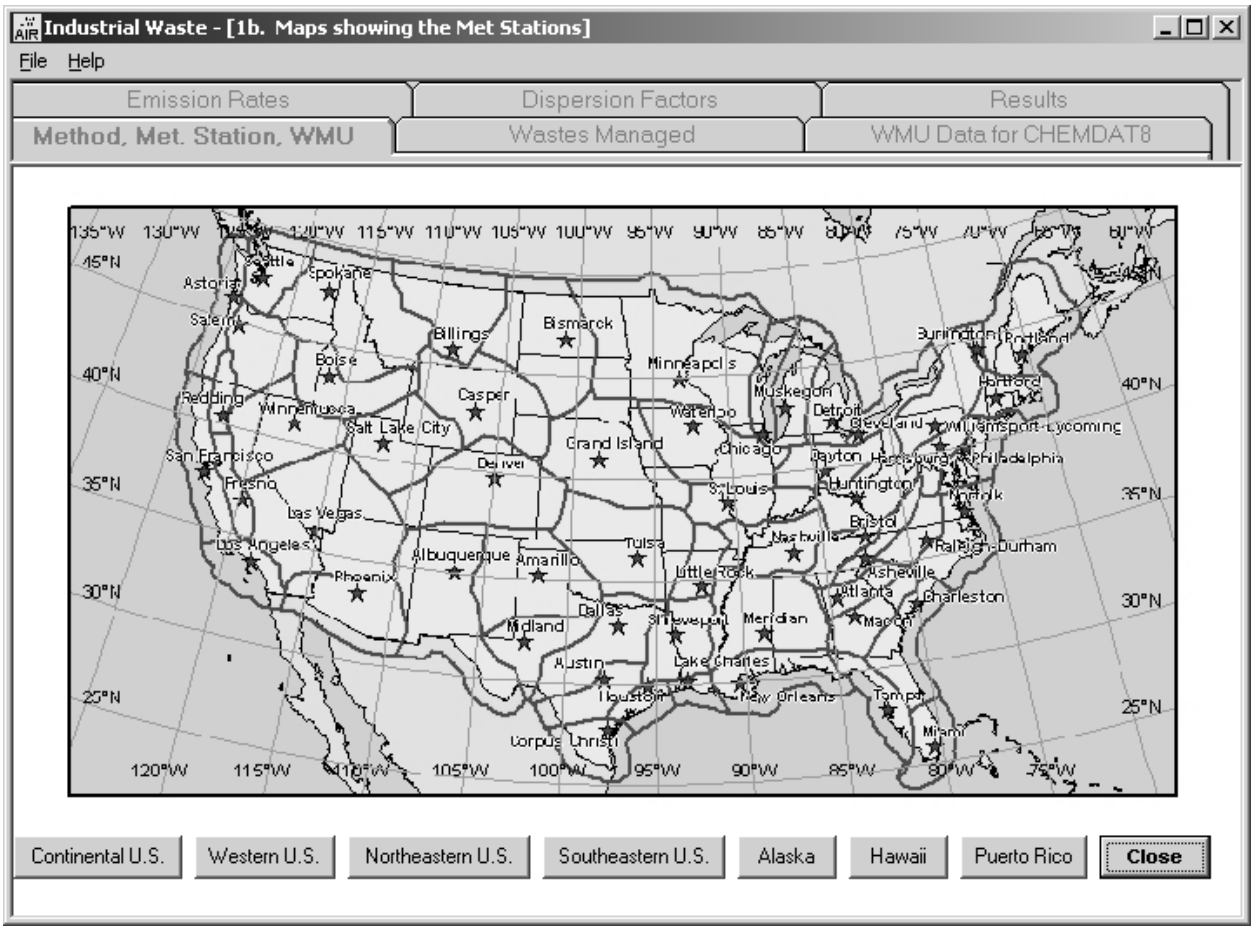
Enter a 5-digit zip code and click on the |SEARCH| button to identify the default meteorological station. If the zip code was entered incorrectly or if no data were provided at all, message boxes will appear to indicate the specific problem that the tool encountered so that you can supply the needed data. The zip code database includes zip codes established through 1999. If your facility has a new zip code that was established more recently, you will get an error message indicating that it is not a valid zip code because it is not in IWAIR's database. If this occurs, you can use your old zip code, use a nearby zip code, or select a meteorological station using latitude and longitude.

Enter Latitude and Longitude Information and Search for Meteorological Station

As shown in Screen 1A, enter the latitude and longitude of the site in degrees, minutes, and seconds. At a minimum, the program requires degrees for latitude and longitude to be entered. If available, the minutes and seconds should be supplied to ensure that the most appropriate station is selected for a site. After these data are entered, click on the |SEARCH| button to identify the default meteorological station. If the latitude and longitude information was entered incorrectly or if no data were provided at all, message boxes will be displayed that indicate the specific problem that the tool encountered so that you can supply the needed data.

D. View Selected Meteorological Station (Screen 1A)

The meteorological station selected by the tool will be displayed in the text box. Once the meteorological station is selected, you are encouraged to click on the |VIEW MAP| button to view the maps showing the 60 meteorological stations to ensure that the selection was made correctly. For example, if the latitude of a site was entered incorrectly, then the selected meteorological station would likely not be the most representative station. In this case, the map will help you identify this error before proceeding with the calculations. Clicking on the |VIEW MAP| button will bring up a map of the 48 contiguous states (Screen 1B, shown here). You may view six additional maps (regional maps for the northeastern, southeastern, and western areas of the 48 contiguous states, as well as maps of Hawaii, Alaska, and Puerto Rico) by clicking on the appropriate button at the bottom of Screen 1B. The |CLOSE| button returns you to the METHOD, MET. STATION, WMU Screen (Screen 1A).



Screen 1B. Map of 48 Contiguous States Showing 60 Meteorological Stations

E. Select Emission and Dispersion Option (IWAIR-Generated or User-Specified) (Screen 1A)

You must select from the IWAIR emission and dispersion data options. Under these options, you have the flexibility of conducting modeling using IWAIR-generated emission rate and dispersion factor estimates, user-specified emission and dispersion estimates, or a combination of IWAIR-generated and user-specified estimates.

The tool uses emission rate and dispersion factor estimates in both the risk and allowable concentration modes. As seen in Screen 1A, you must select one of the three options provided for obtaining emission and dispersion data:

- *Use CHEMDAT8*

  Select |USE CHEMDAT8| to use CHEMDAT8 for calculating the emissions from your unit regardless of whether you want to calculate or enter dispersion factors. This allows you to enter a variety of unit-specific information that IWAIR will use

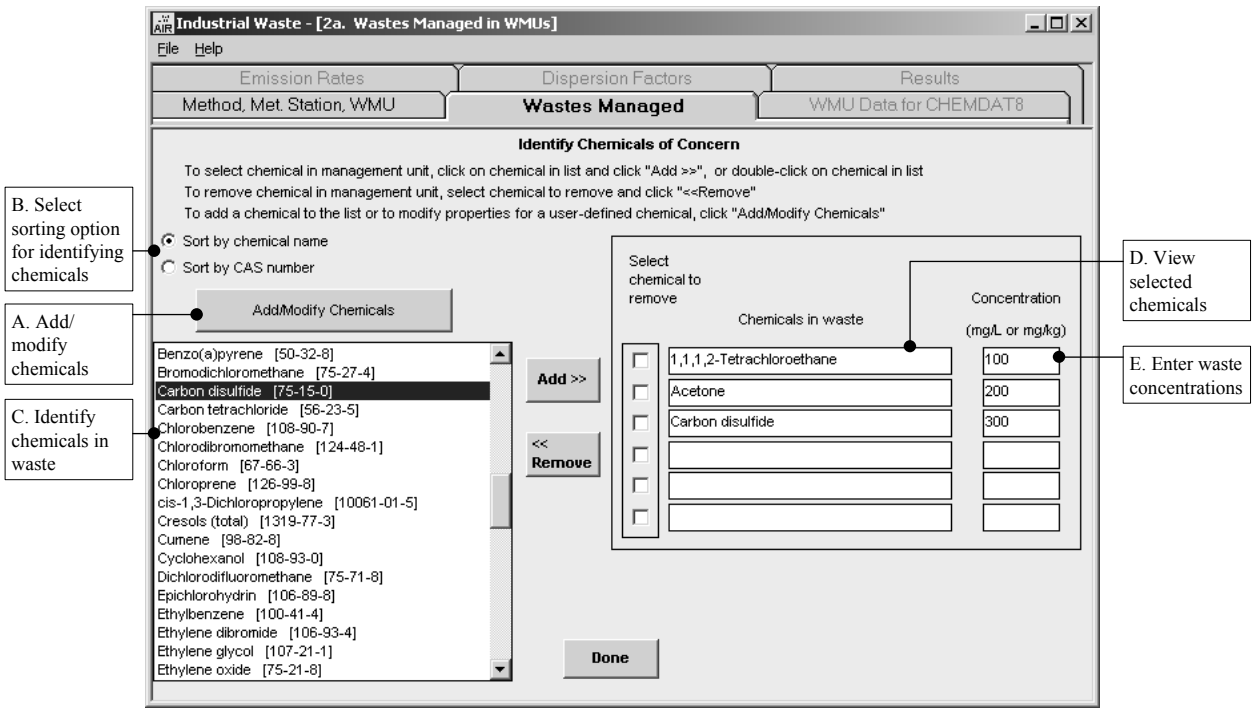
to develop chemical-specific emission rate estimates through the use of EPA's CHEMDAT8 model. These inputs also provide the information needed to use the ISCST3 dispersion factors provided with IWAIR; however, you may also enter your own dispersion factors. You will be allowed to override the IWAIR emission estimates on subsequent screens. This option corresponds to Pathways 1 and 2 (see Section 3.3 and Figures 4-1 and 4-2).

- *Enter Emission Rates*

  Select |ENTER EMISSION RATES| to enter your own site-specific emission rates (g/m^2-s) on a subsequent screen. Rates may be developed based on monitoring data or measurements or by conducting modeling with a different emission model. Under this option, IWAIR can be used to estimate dispersion based on ISCST3 default dispersion factors. If this option is selected, you will still be allowed to override the IWAIR dispersion factors on subsequent screens with site-specific dispersion factors ($\mu g/m^3$ per $\mu g/m^2$-s). Once the |ENTER EMISSION RATES| command button is selected, a message box will appear that directs you to enter WMU area (m^2). If a waste pile is being modeled, a subsequent box will appear for the height of the unit to be entered. These WMU data are used by the model to calculate dispersion estimates. This option corresponds to Pathway 3 (see Section 3.3 and Figure 4-3).

- *Enter Emission, Dispersion Data.*

  Select |ENTER EMISSION & DISPERSION DATA| to enter your own emission estimates (g/m^2-s) and dispersion factors ($\mu g/m^3$ per $\mu g/m^2$-s). This option corresponds to Pathway 4 (see Section 3.3 and Figure 4-4).



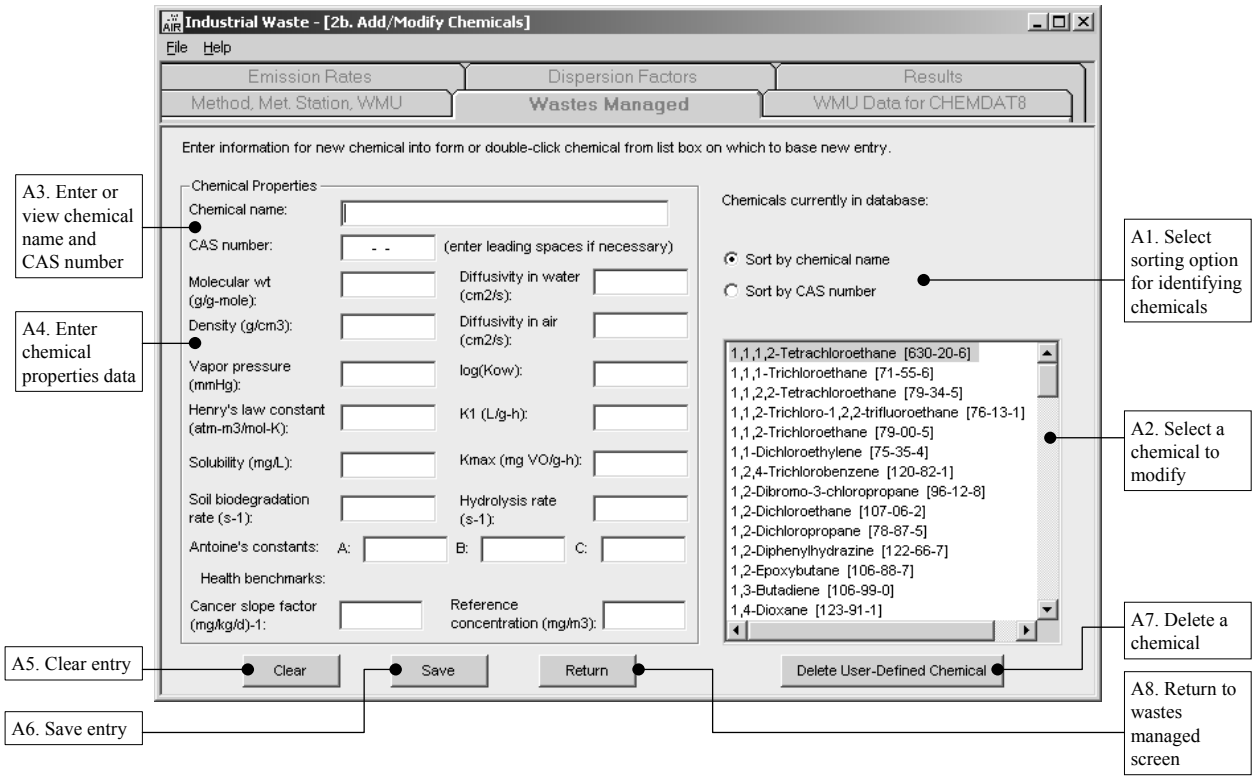
Screen 2A. Wastes Managed

4.2 Wastes Managed (Screen 2A)

To perform a risk calculation, identify the chemical(s) in the waste being managed, and if you are using CHEMDAT8, enter the concentration (mg/L or mg/kg) of each chemical. You may also choose to add or modify chemical data from this screen.

A. Add/Modify Chemicals (Screen 2A)

IWAIR includes a list of chemicals from which you can identify waste constituents. As a convenience to the user, IWAIR includes data on 95 constituents (shown with their CAS number in Section 1, Table 1-1). However, this list of chemicals may not include all the organic chemicals in your waste, and the data for these 95 chemicals may not match your site-specific conditions for some properties. Therefore, IWAIR has the capability to add or modify chemicals. To add or modify chemical data, click on the |ADD/MODIFY CHEMICALS| button. This will bring up Screen 2B, ADD/MODIFY CHEMICALS.



Screen 2B. Add/Modify Chemicals

The ADD/MODIFY CHEMICALS screen will initially appear with no data in any of the fields. You have four options:

- **Add a new chemical**. To do this, enter all data, including chemical name and CAS number, manually.

- **Add a new entry for a chemical already in the database**. To do this, select an existing entry for the chemical for which you wish to add an entry; if you select a user-defined entry, IWAIR will ask if you want to create a new entry. Click on |YES|. If you select an original IWAIR entry, IWAIR will automatically create a new entry.

- **Modify the data in an existing user-defined entry**. To do this, select the chemical to modify; when IWAIR asks if you want to create a new entry, click on |NO|. Original IWAIR entries may not be modified; if you select one, IWAIR will automatically create a new entry.

- **Delete an existing user-defined entry**. Select the entry to delete. Original IWAIR entries may not be deleted.

To ensure the integrity of the original IWAIR data and distinguish user-defined entries, IWAIR will automatically generate a unique identifier for each chemical entry added to the data set in the format "User X," where "X" is an entry number and "User" indicates it is a user-defined entry. This identifier will be appended to the chemical name to uniquely identify each entry. This identifier will be shown on screens and reports whenever the chemical is identified to clearly indicate which chemical entry has been used.

Mercury is included in the IWAIR database in both divalent and elemental forms, but because of code modifications needed for mercury (to reflect differences in its behavior, since it is not an organic chemical), you may not create additional or modified entries for mercury.

A1. Select Sorting Order for Identifying Chemicals (Screen 2B)

The list of chemicals that is currently available in the database is shown here so that you can select constituents to modify. This list includes the 95 constituents included with IWAIR, as well as any you have already added to the IWAIR database. To facilitate the chemical selection process, IWAIR allows you to sort this list of chemicals alphabetically by chemical name, or by CAS number. As shown in Screen 2B, select a sort order by clicking on the button to the left of the sorting option of choice.

A2. Select a Chemical to Modify (Screen 2B)

If you wish to add a new entry for an existing chemical or modify an existing user-defined entry, double-click on the chemical name in the list of chemicals. This will display the data for that chemical on the ADD/MODIFY CHEMICALS screen. If you select one of the 95 original IWAIR chemicals, a new entry will be generated automatically with a new, unique identifier. If you select a user-defined entry, IWAIR will ask if you want to create a new entry. Click on |YES| to create a new entry (you will be able to modify the data) or |NO| to edit the existing entry.

A3. Enter or View Chemical Name and CAS Number (Screen 2B)

If you selected a chemical to modify or to update with a new entry, the chemical name and CAS number will be displayed. These may not be edited, to preserve the integrity of the unique chemical identifiers. If you are adding a new chemical and therefore entering all data manually, you will need to enter an appropriate chemical name and CAS number in these text boxes. Do not include a "User X" designation in your chemical name—IWAIR will append that automatically. Chemical names may not contain apostrophes (') or quotation marks ("). CAS numbers that are shorter than the maximum length should be prefaced with leading spaces, not zeros.

A4. Enter Chemical Properties Data (Screen 2B)

Enter values for all chemical properties shown on the screen. Use the mouse to click in each text box, or use the |TAB| key to move between the boxes. Except for health benchmarks, you may only enter numeric values (although you may enter numeric values

in scientific notation). For health benchmarks, "NA" may also be entered. Be sure to enter values in the units shown. Additional guidance on obtaining values for these parameters is available in Appendix B, Section B.2.2.3.

You may enter user-defined health benchmarks both here, in a user-defined chemical record, and on the RESULTS screen. On the RESULTS screen, you can enter them directly into an IWAIR chemical record without overwriting the original IWAIR value. If you are entering a new or modified chemical entry, you should enter any user-defined health benchmarks here. However, you need not create a new chemical entry here just to change the benchmark of an IWAIR chemical; you can enter the user-defined health benchmark on the RESULTS screen.

A5. Clear Entry (Screen 2B)

To clear an unwanted entry from the ADD/MODIFY CHEMICALS screen without saving, click on the |CLEAR| button. You will be asked to confirm that you want to clear the data.

A6. Save Entry (Screen 2B)

Once all data have been entered, you can save by clicking on the |SAVE| button. IWAIR does some limited range checking to ensure values are within physically possible ranges; if an entry is not in the acceptable range, IWAIR will display an error message with the accepted range. These ranges are intended to eliminate only impossible entries (e.g., negative values for many properties) or values that will cause the model to fail. The actual range for most of the chemical properties is likely smaller than the accepted range. Once all data values have been validated and the entry added to the database, the form will be cleared.

A7. Delete a Chemical (Screen 2B)

You may delete a user-defined chemical entry on the ADD/MODIFY CHEMICALS screen by selecting the chemical from the list of chemical entries and clicking on the |DELETE USER-DEFINED CHEMICAL| button. It is not necessary to double-click on the chemical to bring up its data before deleting; a single click to select the entry in the list is sufficient. If you have selected an original IWAIR chemical entry, an error message will appear indicating that the entry cannot be deleted. If you have selected a user-defined entry, a message will appear to confirm that you want to delete the entry. If you select |YES|, the entry will be deleted from the database and you will be returned to the ADD/MODIFY CHEMICALS screen. The list of chemicals on this screen will be updated to reflect the removal of the entry. If you select |NO|, you will be returned to the screen, and the chemical will not be deleted.

Note that the deletion of a chemical entry used in a saved analysis will lead to the failure of the saved analysis to reload.

A8. Return to Wastes Managed Screen (Screen 2B)

Once you have completed all desired data additions, modifications, and deletions, click the |RETURN| button to return to the WASTES MANAGED screen. If you have unsaved data, IWAIR will warn you and ask if you want to proceed. If you select |YES|, the unsaved data will be lost. If you select |NO|, you will be returned to the ADD/MODIFY CHEMICALS screen, where you can save your data by selecting |SAVE|.

The list of available chemicals in the WASTES MANAGED screen will be updated to include any new entries and to omit any deleted entries.

B. Select Sorting Option for Identifying Chemicals (Screen 2A)

Once you have returned to the WASTES MANAGED screen, you can identify waste constituents from the list of chemicals included in IWAIR. This list includes the 95 constituents included with IWAIR, as well as any you add to the IWAIR database using the ADD/MODIFY CHEMICALS feature. The 95 constituents included with IWAIR are shown with their CAS number in Section 1, Table 1-1. To facilitate the chemical identification process, IWAIR allows you to sort this list of chemicals alphabetically by chemical name, or by CAS number. As shown in Screen 2A, select a sort order by clicking on the button to the left of the desired sorting option.

C. Identify Chemicals in Waste (Screen 2A)

Identify up to six chemicals in a waste for modeling with IWAIR. Identify a chemical by clicking on the chemical name or CAS number and clicking on the |ADD>>| command button. To remove a waste constituent from consideration, select the check box located to the left of the chemical name and click the |<<REMOVE| command button. User-defined entries are identified in this list by the modifier "User X" appended to the chemical name, where "X" is a unique number.

You may choose to simultaneously model the same chemical using multiple entries from the chemical database. You may want to do this to compare results based on changes you have made in chemical properties. However, you should note that the resulting total risk (across all chemicals modeled) presented on the RESULTS screen will reflect double-counting for any chemicals duplicated and will, therefore, not be an accurate estimate of total risk. Chemical-specific risk results will be accurate.

D. View Selected Chemicals (Screen 2A)

The chemicals you identified for consideration are displayed in text boxes shown on Screen 2A. You can remove waste constituents from consideration by selecting the check box to the left of the chemical and clicking the |<<REMOVE| command button.

E. Enter Waste Concentrations (Screen 2A)

If you are using CHEMDAT8, enter a chemical-specific waste concentration for each chemical identified. This is not necessary if you are not using CHEMDAT8. The concentration should be expressed as mg/L for wastewaters and mg/kg for solid wastes.

The total concentration (the sum of all concentrations entered) may not exceed the physical limit of 1,000,000 mg/L or mg/kg; if this occurs, an error message will be displayed and the program will not proceed until the total concentration is less than or equal to 1,000,000 mg/L or mg/kg. In addition, if the total concentration exceeds 10 percent (100,000 mg/L or mg/kg), a message will be displayed advising you to consider characterizing the waste as an organic waste in the WASTE MANAGEMENT UNITS screen (Screen 3A, 3B, 3C, or 3D). The distinction between aqueous and organic wastes is discussed briefly in Section 4.3C and in more detail in Appendix B, Sections B.3.1.4, B.3.2.4, B.3.3.4, and B.3.4.4.

Chemicals with entered waste concentrations that lead to concentrations in the unit in excess of the solubility limit in the IWAIR database (for surface impoundments) or the soil saturation limit calculated by IWAIR (for other unit types) for that chemical will be modeled somewhat differently by CHEMDAT8. Typically, chemicals above saturation or solubility limits in the unit will come out of solution, and if this is occurring, the waste would be best modeled as an organic-phase waste. However, these limits can be somewhat site-specific; therefore, IWAIR does not prevent you from entering waste concentrations in excess of these limits, nor does it require you to model wastes with concentrations in excess of these limits as organic-phase wastes. Instead, IWAIR assumes that the chemical remains in solution, either because of waste matrix effects in your unit or because the actual solubility or soil saturation limit in your unit is higher than that specified in the database or calculated by IWAIR because of site-specific conditions. However, even though IWAIR continues to model such wastes as aqueous-phase wastes (unless you select organic-phase), it uses a different partition coefficient that more appropriately models this situation. IWAIR will notify you that this was done after emissions are calculated (because determining when this is the case depends on data entered after the WASTES MANAGED screen). In addition, printed reports will document the use of the alternative emissions modeling approach.

4.3 Enter WMU Data for Using CHEMDAT8 Emission Rates

If you elected to use CHEMDAT8 emission rates in the risk calculations (i.e., selected the |USE CHEMDAT8| command button shown previously on Screen 1A), you will need to enter WMU data as specified in this section. If you did not elect to use CHEMDAT8 emission rates, then you should proceed to Section 4.4, *Emission Rates*. If you elected to enter emission rates and use ISCST3 dispersion factors, you will be asked to enter the WMU area (and height, if a waste pile) for ISCST3 before proceeding to the emissions screen.

This section provides guidance on providing input data needed to develop CHEMDAT8 emission estimates for the four unit types addressed by IWAIR.

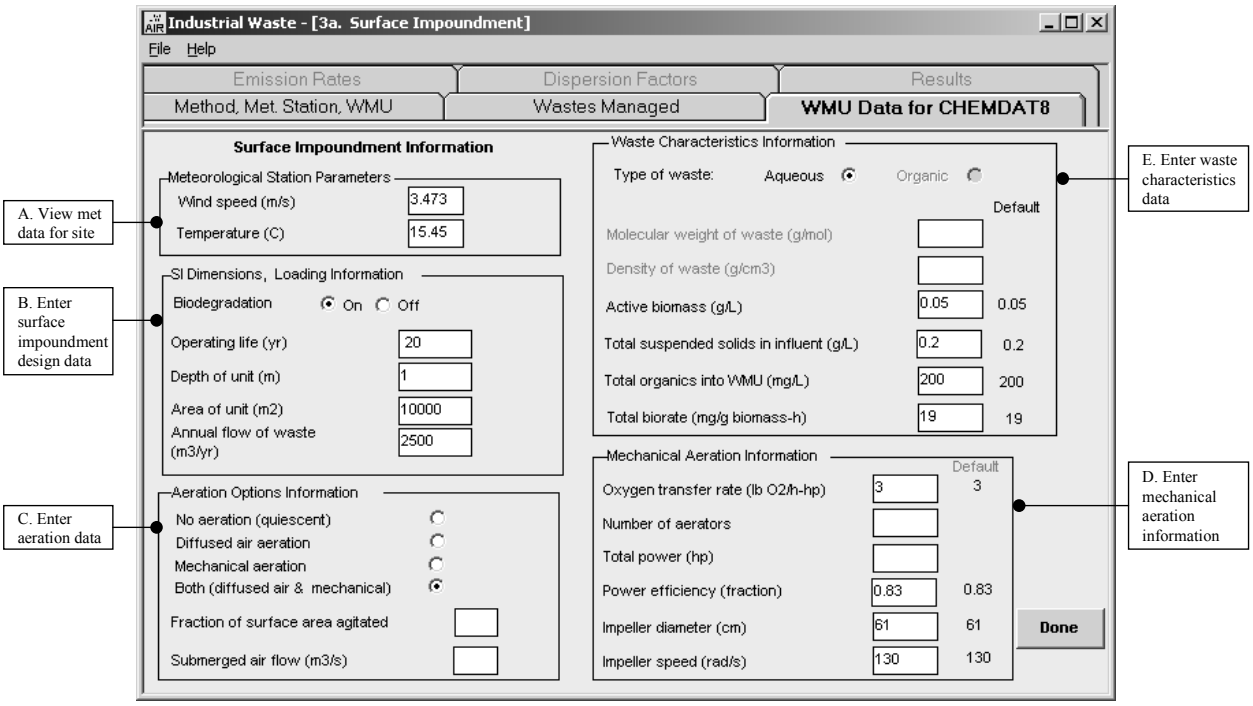
Surface Impoundments. The major source of volatile emissions associated with surface impoundments is the uncovered liquid surface exposed to the air (U.S. EPA, 1991). Aeration and/or agitation are applied to aid in treatment of the waste, and emissions tend to increase with an increase in surface turbulence because of enhanced transfer of liquid-phase contaminants to the air (U.S. EPA, 1991). Parameters to which emissions are most sensitive include surface area, unit depth, waste concentration, retention time, wind speed for quiescent systems, and biodegradation. Retention time is not an explicit input, but is a function of impoundment volume and flow.

Land Application Units. Waste can be tilled or sprayed directly onto the soil and subsequently mixed with the soil by discing or tilling. Waste in a land application unit is a mixture of sludge and soil. IWAIR allows the modeling of tilled land application units. If your unit uses spray application, another model may be more appropriate. Air emissions from land treatment units are dependent on the chemical/physical properties of the organic constituents, such as vapor pressure, diffusivity, and biodegradation rate. Operating and field parameters affect the emission rate, although their impact is not as great as that of the constituent properties.

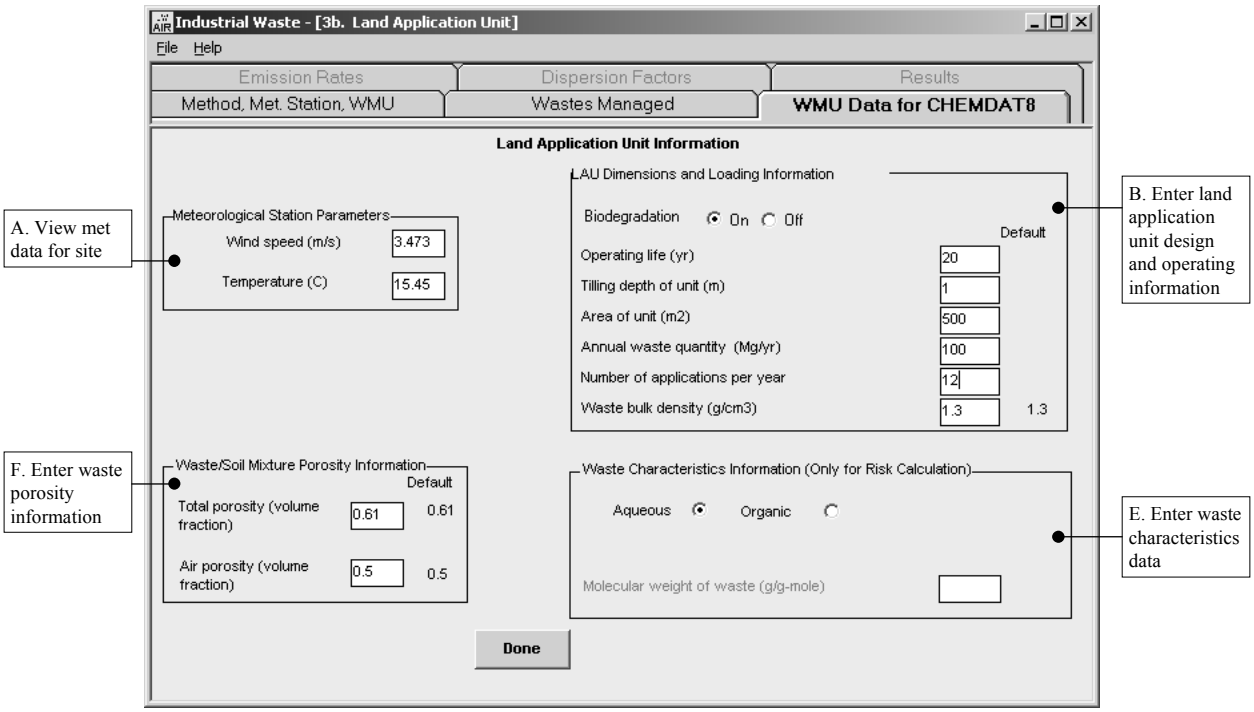
Active Landfill. IWAIR allows the modeling of emissions released from the surface of an active (i.e., receiving wastes) landfill. The landfill model is sensitive to the air porosity of the solid waste, the liquid loading in the solid waste, the waste depth (assumed to be the same as the unit depth), the constituent concentration in the waste, and the volatility of the constituent (U.S. EPA, 1991).

Waste Piles. The waste pile emission model is sensitive to the air porosity of the solid waste, the liquid loading in the solid waste, the waste pile height, the constituent concentration in the waste, and the volatility of the constituent (U.S. EPA, 1991).

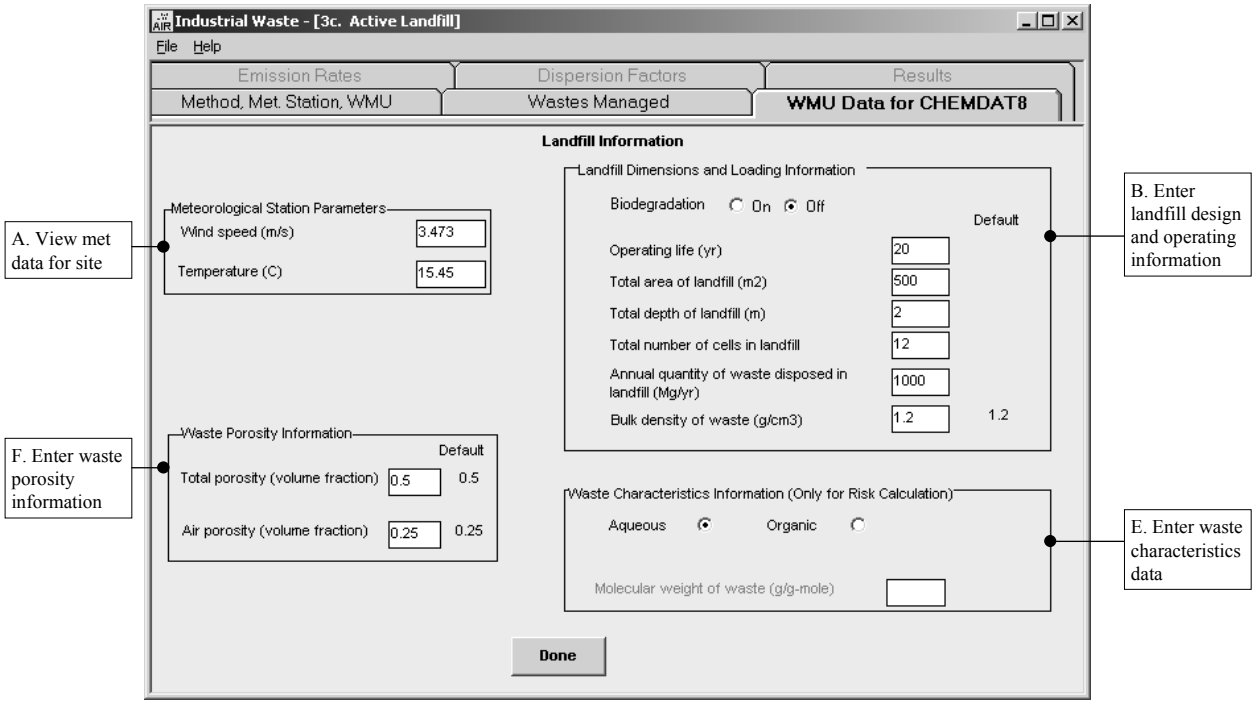
Screens 3A, 3B, 3C, and 3D, respectively, identify the CHEMDAT8 input requirements for surface impoundments, land application units, landfills, and waste piles. Guidance for completing each screen is provided below. For some of the required inputs, default values are provided in the screen text boxes, as well as to the right of the text boxes. These default values were selected to represent average or typical operating conditions. If appropriate, the defaults can be applied in the absence of site-specific data; however, you always have the option of overriding any defaults. The basis for these default values is provided in the *IWAIR Technical Background Document*.



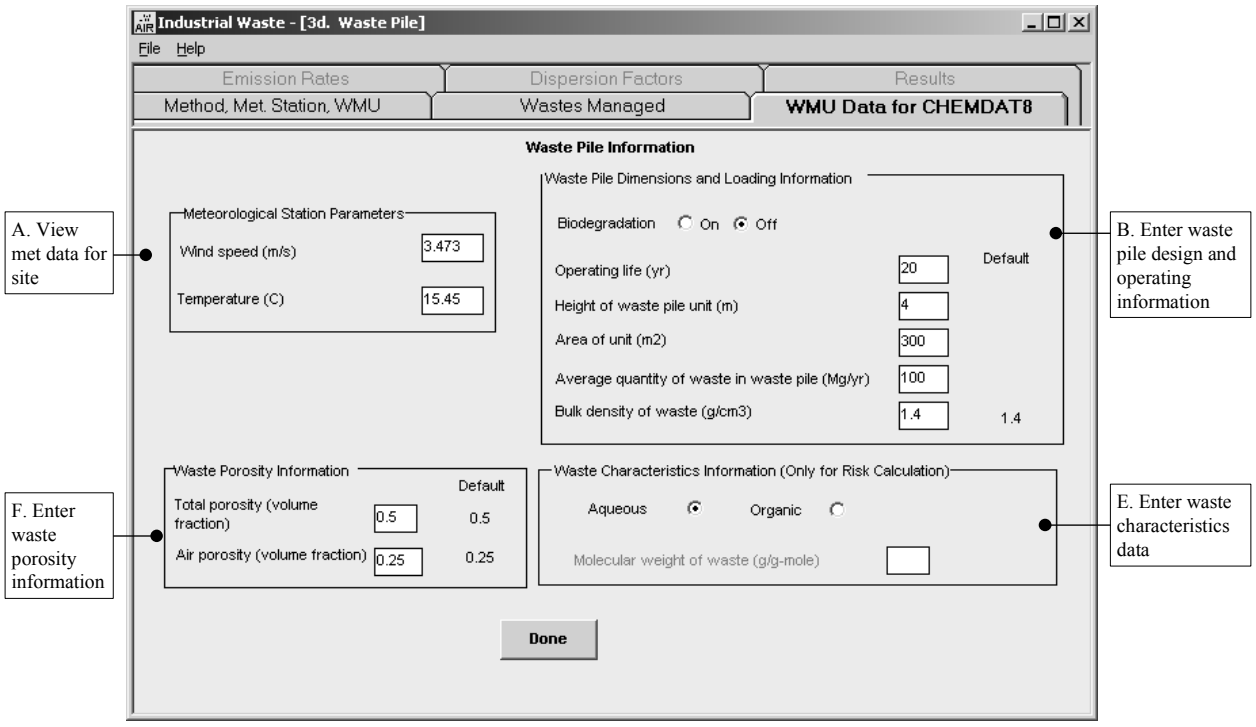
Screen 3A. WMU Data for CHEMDAT8: Surface Impoundment



Screen 3B. WMU Data for CHEMDAT8: Land Application Unit



Screen 3C. WMU Data for CHEMDAT8: Landfill



Screen 3D. WMU Data for CHEMDAT8: Waste Pile

A. View Meteorological Data for Site (Screens 3A, 3B, 3C, and 3D)

Both wind speed and temperature can affect the volatilization rate of a chemical. Average wind speed and temperature are used as input to the CHEMDAT8 model. Average annual wind speed is used to select the most appropriate empirical emission correlation equation in CHEMDAT8; there are several of these correlations, and each one applies to a specific range of wind speeds and unit sizes. Average annual temperature is used to adjust Henry's law constant and vapor pressure values (temperature-dependent chemical properties) from a standard temperature to the ambient temperature at the unit. Drawing from the meteorological data stored in IWAIR, the program will display the average annual temperature and wind speed available for the representative meteorological station that was determined for the site in Screen 1A. You can enter average wind speed and temperature for your site if the default values are significantly different.[2]

B. Enter Unit Design and Operating Data

For all unit types, you may select whether or not biodegradation occurs in your unit. Select the |ON| option to turn biodegradation on and the |OFF| option to turn it off. The default setting varies by unit type. See Appendix B, Sections B.3.1.2, B.3.2.3, B.3.3.3, and B.3.4.3, for further details about the implications of turning biodegradation on or off and the appropriateness of difference choices for different unit types.

Enter Surface Impoundment Design Data (Screen 3A)

Enter the unit dimensions and loading information in the text boxes shown in Screen 3A. The data include the operating life at the unit (yrs), the depth of the unit (m), the area of the unit (m^2), and the annual flow of the waste (m^3/yr).

Enter Land Application Unit Design and Operating Information (Screen 3B)

Enter the unit dimensions and loading information in the text boxes shown in Screen 3B. The data include the operating life of the unit (yrs), tilling depth of the unit (m), area of the unit (m^2), annual waste quantity (Mg/yr), number of applications per year, and waste bulk density (g/cm^3).

Enter Landfill Design and Operating Information (Screen 3C)

Enter the unit dimensions and loading information in the text boxes in Screen 3C. The model assumes that the landfill is divided into cells, with only one cell active at a time. Emissions are modeled from the active cell. The data to be entered include the operating life of the unit (yrs), total area of the unit (m^2), depth of the unit (m), number of cells in your unit, annual quantity of wastes disposed in the unit (Mg/yr), and bulk density of waste (g/cm^3).

[2] These inputs are not used in the dispersion modeling, which uses hourly data, not annual averages. Therefore, changes to these inputs will not affect the dispersion factors.

Enter Waste Pile Design and Operating Information (Screen 3D)

Enter the unit dimensions and loading information in the text boxes in Screen 3D. The data include the operating life of the unit (yrs), the height of the pile (m), area of the unit (m^2), annual quantity of waste in the pile (Mg/yr), and bulk density of the waste (g/cm^3).

C. For Aerated Surface Impoundments Only – Enter Aeration Data (Screen 3A)

IWAIR models both quiescent (nonaerated) and aerated impoundments. Aeration or agitation of a liquid waste in an impoundment enhances transfer air (oxygen) to the liquid to improve mixing or to increase biodegradation (U.S. EPA, 1991). Aeration is achieved through the use of mechanical mixers, such as impellers (i.e., mechanically aerated), or by sparging air, which bubbles up from the bottom of the unit (i.e., diffused air aerated). First, select the aeration option that best describes your unit by clicking the appropriate option button. If you selected one of the aerated options, provide information to characterize the aeration in your unit. For all aeration options, you will need to enter the fraction of the surface area agitated (unitless). If you selected an option including diffused air aeration (diffused air only or both diffused air and mechanical aeration), you will also need to enter the total submerged air flow (m^3/s) of all diffusers in the impoundment.

If you choose to model an aerated impoundment, you will not have the option of modeling an organic-phase waste; IWAIR cannot model an organic-phase waste in an aerated impoundment because of limitations in CHEMDAT8.

D. For Mechanically Aerated Surface Impoundments Only – Enter Mechanical Aeration Information (Screen 3A)

If a surface impoundment is mechanically aerated, you will need to provide additional operating parameter information. These data include oxygen transfer rate (lb O_2/hr-hp), number of aerators, total power (hp), power efficiency (fraction), impeller diameter (cm), and impeller speed (rad/s).

E. Enter Waste Characteristics Data (Screens 3A, 3B, 3C, and 3D)

For Surface Impoundments Only – Enter Waste Characteristics Data (Screens 3A)

For nonaerated impoundments, specify whether the waste being modeled is an aqueous- or organic-phase waste. IWAIR cannot model organic-phase wastes for aerated impoundments; therefore, if you selected an aeration option other than nonaerated, the organic option will not be enabled. Appendix B, Section B.3.1.4 contains detailed guidance on determining whether your waste is aqueous or organic, including definitions of those terms. Briefly, in making the determination of whether a waste is aqueous or organic, you should examine the fraction of the waste that is organic. Consider the following guidance in making this determination.

Organic: If the total concentration of all organics in the waste is greater than 10 percent, then the waste is probably most appropriately modeled as organic. IWAIR will suggest this if the combined concentration of all chemicals entered is greater than 100,000 or mg/L, or 10 percent, but it will not automatically select the organic option; IWAIR always defaults to aqueous, and you must explicitly select the organic option if you determine that it is more appropriate.

Aqueous: If the total concentration of all organics in the waste is less than 10 percent, then the waste is probably more appropriately modeled as aqueous. The default in IWAIR is always aqueous.

Based on your selection of aqueous or organic, IWAIR will apply either the aqueous or the organic waste equilibrium partitioning algorithm. For organic wastes, the model uses Raoult's law, and the liquid-to-air partition coefficient becomes proportional to the contaminant's partial vapor pressure. For aqueous wastes, which are assumed to partition predominantly to water (e.g., rain and water in the soil), the model uses Henry's law and the liquid-to-air partition coefficient becomes proportional to the contaminant's Henry's law coefficient.[3] This is discussed in greater detail in Appendix B, Section B.3.1.4.

If you choose to model an organic-phase waste, you will also need to enter the waste density (g/cm^3) and the average molecular weight of the waste (g/mol). Appendix B, Section B.3.1.4, provides details on how to estimate these parameters.

Additional waste characteristics information to be entered for surface impoundments includes active biomass (g/L), total suspended solids into WMU (mg/L), total organics into WMU (mg/L), and total biorate (mg/g biomass-hr). These parameters are discussed in more detail in Appendix B.

Land Application Units , Landfills, and Waste Piles Only – Enter Waste Characteristics Data (Screens 3B, 3C, and 3D)

Specify whether the waste being modeled is an aqueous- or organic-phase waste. Appendix B, Sections B.3.2.4, B.3.3.4, and B.3.4.4, contain detailed guidance on determining whether your waste is aqueous or organic, including definitions of those terms. Briefly, in making the determination of whether a waste is aqueous or organic, you should examine the fraction of the waste that is organic. Consider the following guidance in making this determination.

Organic: If the total concentration of all organics in the waste is greater than 10 percent, then the waste is probably most appropriately modeled as organic. IWAIR will suggest this if the combined concentration of all chemicals

[3] This assumes the chemical concentration in the impoundment is at or below the chemical's solubility limit. If it is above the solubility limit, IWAIR uses a hybrid of the aqueous-phase and organic-phase modeling approaches. See Appendix B, Section B.3.1.4.

entered is greater than 100,000 mg/kg, or 10 percent, but it will not automatically select the organic option; IWAIR always defaults to aqueous, and you must explicitly select the organic option if you determine that it is more appropriate.

Aqueous: If the total concentration of all organics in the waste is less than 10 percent, then the waste is probably more appropriately modeled as aqueous. The default in IWAIR is always aqueous.

Based on your selection of aqueous or organic, IWAIR will apply either the aqueous or the organic waste equilibrium partitioning algorithm. For organic wastes, the model uses Raoult's law and the liquid-to-air partition coefficient becomes proportional to the contaminant's partial vapor pressure. For aqueous wastes, which are assumed to partition predominantly to water (e.g., rain and water in the soil), the model uses Henry's law, and the liquid-to-air partition coefficient becomes proportional to the contaminant's Henry's law coefficient.[4] This is discussed in greater detail in Appendix B, Sections B.3.2.4, B.3.3.4, and B.3.4.4.

If you choose to model an organic-phase waste, you will also need to enter the average molecular weight of the waste (g/mol). Appendix B, Sections B.3.2.4, B.3.3.4, and B.3.4.4, provide details on how to estimate this parameter.

F. For Land Application Units, Landfills, and Waste Piles Only – Enter Waste Porosity Information (Screens 3B, 3C, and 3D)

Waste (or soil/waste mixture for land application units) porosity information required as input includes total porosity (unitless) and air porosity (unitless). Total porosity includes air porosity and the space occupied by oil and water within waste. Total porosity (ϵ_t), also sometimes called saturated water content, can be calculated from the bulk density (BD) of the waste and particle density (ρ_s) as follows:

$$\epsilon_t = 1 - \frac{BD}{\rho_s}$$

where BD and ρ_s are expressed in the same units.

In the absence of site-specific data, IWAIR identifies default values of 0.5 and 0.25, respectively, for total porosity and air porosity. Air porosity cannot exceed total porosity.

Done. Once you provide the required WMU inputs, click the |DONE| button to enable the EMISSION RATES tab and open the EMISSION RATES screen. Proceed to Section 4.4, *Emission Rates*.

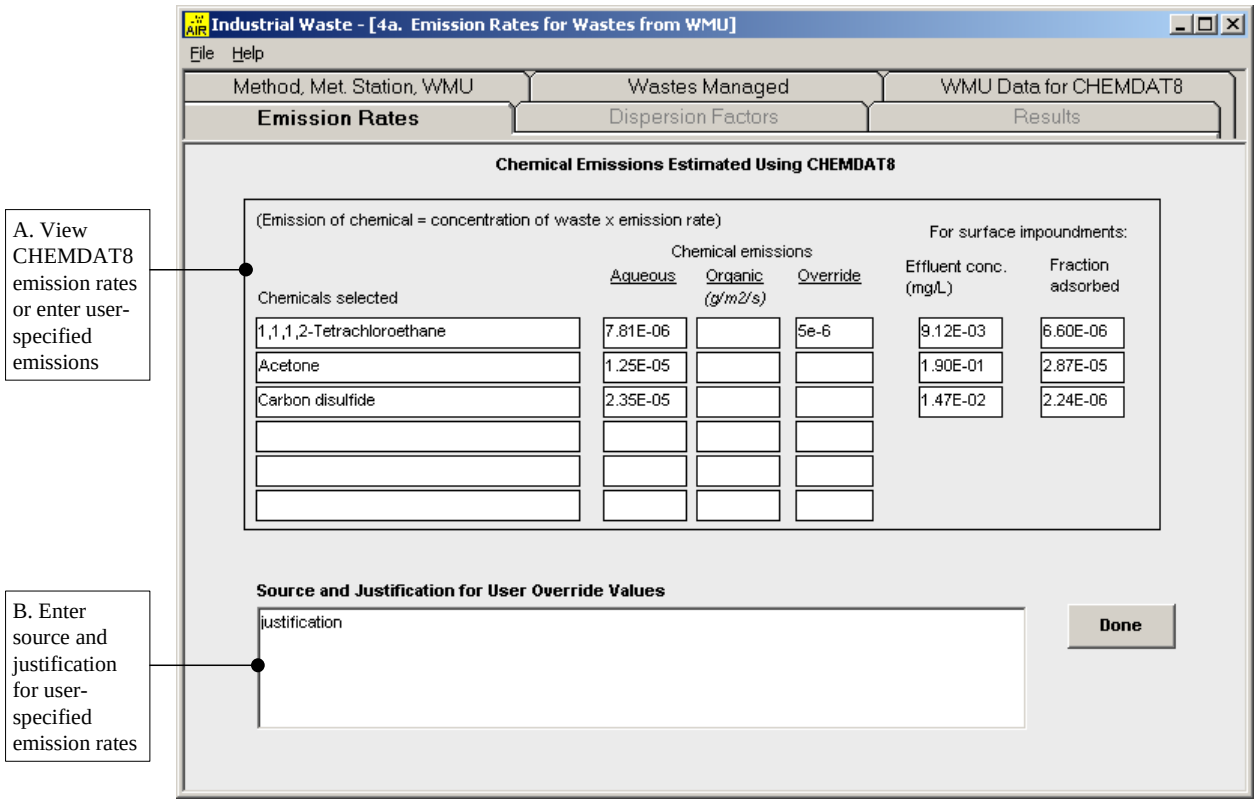
[4] This assumes the chemical concentration in the unit is at or below the chemical's solubility limit. If it is above the solubility limit, IWAIR uses a hybrid of the aqueous-phase and organic-phase modeling approaches. See Appendix B, Sections B.3.2.4, 3.3.4, and B.3.4.4.

IWAIR must calculate emission rates before displaying the EMISSION RATES screen. This is usually very quick, but if your computer is slow, or if you are modeling a land application unit with a large number of total applications (i.e., number of applications per year times operating life), there can be a noticeable delay before the EMISSION RATES screen is displayed. This is normal, but should typically not exceed 1 minute on a fast machine or 5 minutes on a slow machine.

4.4 Emission Rates

Guidance for using CHEMDAT8 emission rates or entering your own emission rates is provided in this section. View and confirm the CHEMDAT8 emission rates as directed in Section 4.4.1. If you did not elect to use CHEMDAT8 (i.e., if you selected the |ENTER EMISSION RATES| or |ENTER EMISSION & DISPERSION DATA| command buttons shown previously on Screen 1A), proceed to Section 4.4.2, *User-Specified Emission Rates*.

Please note that all calculated and entered values on the EMISSION RATES screen will be lost if you return to a previous screen and make changes. This includes both calculated and entered override emission rate values.



Screen 4A. CHEMDAT8: Emission Rates

4.4.1 Using CHEMDAT8 Emission Rates (Screen 4A)

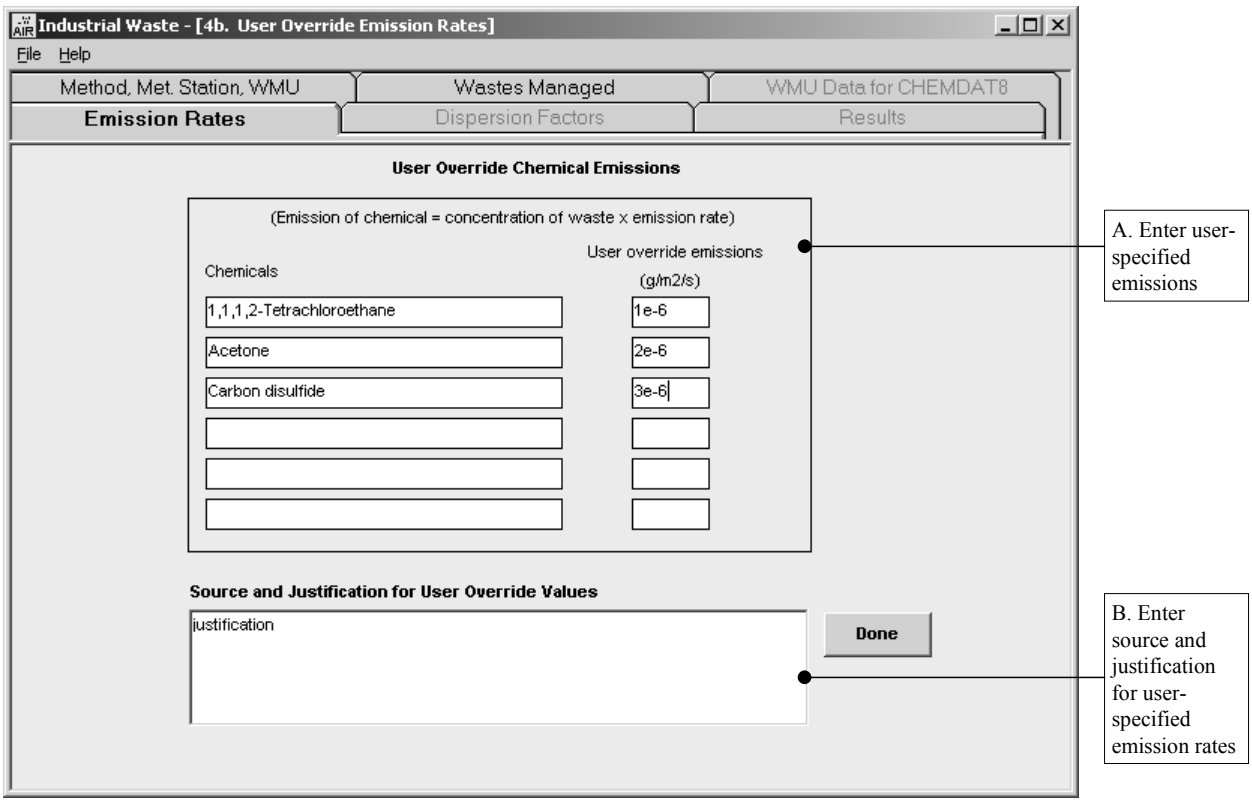
A. View CHEMDAT8 Emission Rates or Enter User-Specified Emissions (Screen 4A)

Screen 4A shows the calculated CHEMDAT8 emission rates. For surface impoundments, this screen also shows the calculated effluent concentrations and fraction adsorbed for each chemical. With the exception of waste managed in aerated surface impoundments (assumed to be aqueous because of model limitations), emission rates will be displayed under the AQUEOUS or ORGANIC column headings depending on how you characterized your waste on the WMU DATA FOR CHEMDAT8 screens (Screens 3A, 3B, 3C, or 3D). If you wish to override the displayed rates, enter alternate rates (g/m^2-s) in the text boxes located under the OVERRIDE heading.

For surface impoundments, landfills, and waste piles, emissions are modeled at equilibrium and are assumed to reflect a long-term average emission rate, which is shown on this screen. In contrast, land application units are not assumed to be at equilibrium; rather, emissions are calculated for each year of the specified operating life plus 30 years postclosure. The emission rates shown on this screen are the maximum single-year emission rates for each chemical (which may not reflect the same year for all chemicals). This emission rate is used directly to calculate the air concentration used for calculating noncarcinogenic risk. However, for carcinogenic risk, the maximum 7- or 30-year average emission rate (7-year for a worker and 30-year for a resident, corresponding to the default exposure durations for each receptor type) is used to calculate air concentration and risk. If you enter user-override emission rates for any unit type, they should reflect a long-term average emission rate. Override emission rates are used as entered in all risk calculations, including both carcinogenic and noncarcinogenic calculations for land application units.

B. Enter Source and Justification for User-Specified Emission Rates (Screen 4A)

If alternative emission rates are entered, IWAIR will prompt you to identify the source and justification for these data. This documentation should be entered in the text box displayed on the screen. It is important to provide this documentation as a reference that will allow you or another user to view and understand saved files at a later date. This information is also printed in reports. Confirm the emission rates to be used in the calculations by clicking the |DONE| button. The program will then automatically enable the DISPERSION FACTORS tab and open the DISPERSION FACTORS screen. Proceed to Section 4.5, *Dispersion Factors*.



Screen 4B. User-Specified Emission Rates

4.4.2 User-Specified Emission Rates (Screen 4B)

A. Enter User-Specified Emissions (Screen 4B)

Enter site-specific emission rates (g/m^2-s) in the text box under USER OVERRIDE EMISSIONS. If you have measured or calculated emission rates in g/s for your entire unit, you will need to divide that emission rate by the total area of your unit (in m^2) to obtain area-normalized emission rates in g/m^2-s. These emission rates should reflect long-term average emissions, not a short-term peak.

B. Enter Source and Justification for User-Specified Emission Rates (Screen 4B)

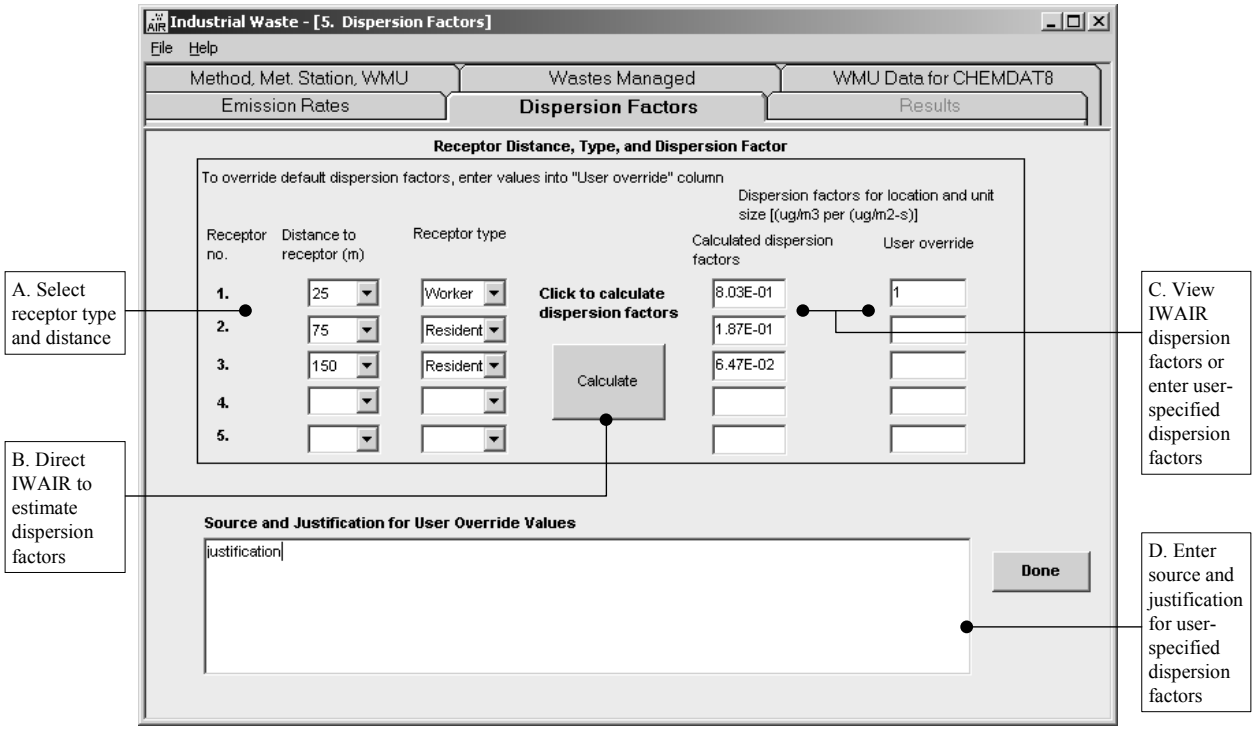
The program will prompt you to provide justification for user-specified emission rates and documentation of the estimation method applied. It is important to provide this documentation as a reference that will allow you or another user to view and understand saved files at a later date.

Done. Once you have entered the emission data and source/justification, click the |DONE| button to enable the DISPERSION FACTORS tab and open the DISPERSION FACTORS screen. Proceed to Section 4.5, *Dispersion Factors*.

4.5 Dispersion Factors

Dispersion modeling outputs are used to estimate air concentrations to which the various human receptors are exposed. Guidance for using the ISCST3 default dispersion factors or entering your own site-specific dispersion factors is provided in Sections 4.5.1 and 4.5.2, respectively. If you elected to use ISCST3 dispersion factors provided in IWAIR (i.e., selected the |USE CHEMDAT8| or |ENTER EMISSION RATES| command buttons shown previously on Screen 1A), you will need to follow the guidance provided in Section 4.5.1. If you did not elect to use the default dispersion factors, you should proceed to Section 4.5.2, *User-Specified Dispersion Factors*.

Please note that all calculated and entered dispersion factors values on the DISPERSION FACTORS screen will be lost if you return to a previous screen and make changes. This does not include receptor locations and types but does include calculated and entered override dispersion factor values.



Screen 5A. Using ISCST3 Default Dispersion Factors

4.5.1 Using ISCST3 Default Dispersion Factors (Screen 5A)

In Screen 5A, you will provide receptor information (i.e., receptor type and distance to the receptor) and click the |CALCULATE| button; IWAIR will develop site-specific dispersion factors based on default dispersion data. If you wish to override the IWAIR-developed dispersion factors, enter alternate site-specific unitized dispersion factors. If you enter alternative dispersion

factors, you should document the source and the justification for these data in the text box on the screen.

A. Select Receptor Type and Distance (Screen 5A)

Enter information concerning the receptors of concern (i.e., potentially exposed individuals). You can specify up to five receptors, including the distance to receptor and the receptor type. You can specify two receptor types, resident or worker, at six distances (25, 50, 75, 150, 500, and 1,000 meters) from the edge of the WMU. You can delete the last receptor entered by deleting both the distance to receptor and receptor type entries.

Distance to Receptor – For each receptor of concern, determine the distance from the edge of the unit to the receptor. Based on this distance, select from the six default distances (25, 50, 75, 150, 500, and 1,000 meters) the one that best approximates the location of your receptor, using the drop-down box positioned under the DISTANCE TO RECEPTOR column heading. Note that selecting a distance smaller than the actual distance to receptors near your unit will overestimate risk, and selecting a distance larger than the actual distance will underestimate risk. These distances correspond to the distances for which air dispersion modeling was conducted to develop the IWAIR default dispersion factors. The *IWAIR Technical Background Document* discusses the analysis that was conducted in determining the appropriateness of these default distances.

Receptor Type – Two different types of exposed individuals, worker and resident, can be modeled with IWAIR. The dispersion factors do not vary with receptor type; however, receptor type is chosen here for convenience. The difference between these two receptor types lies in the exposure factors, such as body weight and inhalation rate, used to calculate risk for carcinogens. There is no difference between them for noncarcinogens, because calculation of noncarcinogenic risk does not depend on exposure factors. The *IWAIR Technical Background Document* describes the exposure factors used for residents and workers. The assumptions for workers reflect a full-time, outdoor worker. The exposure duration for workers is the smaller of 7.2 years or the operating life of the unit. The assumptions for residents reflect males and females from birth through age 30; it is important to consider childhood exposures because children typically have higher intake rates per kilogram of body weight than adults. The actual exposure duration used for residents is the smaller of 30 years or the operating life of the unit that you entered.[5] For exposure durations less than 30 years, exposure starts at birth and continues for the length of the exposure duration, using the appropriate age-specific exposure factors. Use the drop-down box positioned under the RECEPTOR TYPE column heading to select either WORKER or RESIDENT.

B. Direct IWAIR to Estimate Dispersion Factors (Screen 5A)

After the requested receptor information is provided, click on the |CALCULATE| button to direct the program to determine an appropriate dispersion factor based on the IWAIR default

[5] An exception to this is that the exposure duration for land application units is 7.2 years for workers and 30 years for residents regardless of the operating life entered for the unit. This allows IWAIR to account for postclosure exposures, which are assumed to occur with land application units but not with other units.

dispersion data. The resulting dispersion factor will be displayed for each receptor of concern. A discussion of the development of IWAIR default dispersion data and the methodology used by the program in selecting an appropriate dispersion factor for each WMU/receptor combination is provided in Section 3.3. A more detailed discussion of the air dispersion modeling effort is provided in the *IWAIR Technical Background Document*.

For waste piles, IWAIR uses a two-dimensional nonlinear spline to interpolate dispersion factors for areas and heights different from those included in the dispersion factor database. This technique is more accurate than a two-dimensional linear interpolation and is less likely to underestimate the actual dispersion factor. However, on rare occasions, the spline may produce results inconsistent with the data points nearest the actual area and height. If this occurs, IWAIR shifts to the linear interpolation technique, which generally produces somewhat lower dispersion factors. If this occurs, you will see a message to that effect. The interpolation techniques used for dispersion factors are discussed in greater detail in the *IWAIR Technical Background Document*.

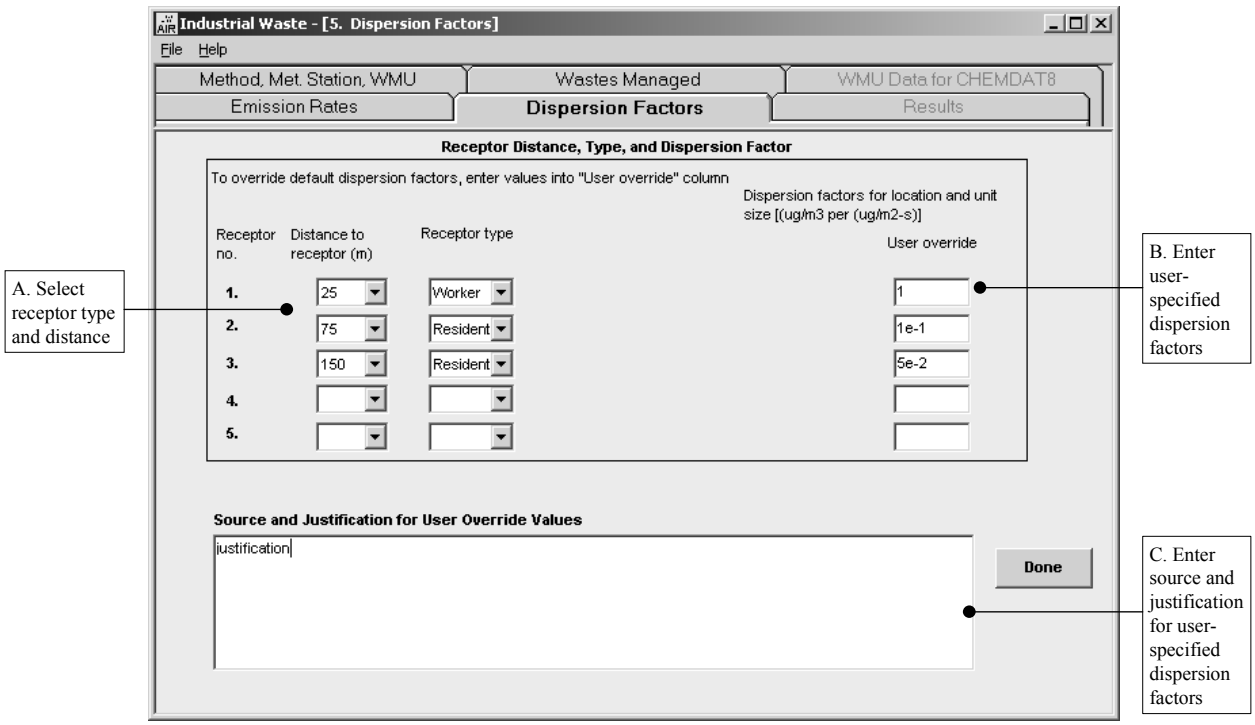
C. View IWAIR Dispersion Factors or Enter User-Specified Dispersion Factors (Screen 5A)

You may override the program-calculated dispersion factors by entering alternative dispersion data in the text box located under the USER OVERRIDE column (see Screen 5A).

D. Enter Source and Justification for User-Specified Dispersion Factors (Screen 5A)

If you choose to provide alternative dispersion factors, document the source and the justification for these data in the text box that will appear. It is important to provide this documentation as a reference that will allow you or another user to view and understand saved files at a later date. This information also appears on printed reports.

Done. Once the program has developed dispersion factors, click the |DONE| button to open the RESULTS tab. Proceed to Section 4.6, *Results*.



Screen 5B. User-Specified Dispersion Factors

4.5.2 User-Specified Dispersion Factors (Screen 5B)

A. Select Receptor Type and Distance (Screen 5B)

Enter information concerning the receptors of concern (i.e., potentially exposed individuals). You can specify up to five receptors. The receptor information includes the distance to receptor and the receptor type. You can specify two receptor types (residents or workers) at six distances (25, 50, 75, 150, 500, and 1,000 meters) from the edge of the WMU. You can delete the last receptor by deleting both the distance to receptor type and receptor type entries.

Distance to Receptor – For each receptor of concern, determine the distance from the edge of the unit to the receptor. Based on this distance, select from the six default distances (25, 50, 75, 150, 500, and 1,000 meters) the one that best approximates the location of your receptor, using the drop-down box positioned under the DISTANCE TO RECEPTOR column heading. These values are only for your reference and are not used in calculations, since you are entering your own dispersion factors.

Receptor Type – Two different types of exposed individuals, WORKER and RESIDENT, can be modeled with IWAIR. The dispersion factors do not vary with receptor type; however, receptor type is chosen here for convenience. The difference between these two receptors is in the exposure factors, such as body weight and inhalation rate, used to calculate risk for carcinogens. There is no difference between them for noncarcinogens because calculation of noncarcinogenic

risk does not depend on exposure factors. The *IWAIR Technical Background Document* describes the exposure factors used for residents and workers. The assumptions for workers reflect a full-time, outdoor worker. The exposure duration for workers is the smaller of 7.2 years or the operating life of the unit. The assumptions for residents reflect males and females from birth through age 30; it is important to consider childhood exposures because children typically have higher intake rates per kilogram of body weight than adults. The actual exposure duration used for residents is the smaller of 30 years or the operating life of the unit that you entered.[6] For exposure durations less than 30 years, exposure starts at birth and continues for the length of the exposure duration, using the appropriate age-specific exposure factors. Use the drop-down box positioned under the RECEPTOR TYPE column heading to select either WORKER or RESIDENT.

B. Enter User-Specified Dispersion Factors (Screen 5B)

For each receptor specified, enter site-specific unitized dispersion factors ($\mu g/m^3$ per $\mu g/m^2$-s) in the text box located under USER OVERRIDE. You may need to normalize modeled dispersion factors to a unit concentration by dividing the modeled dispersion factor by the emission rate used in dispersion modeling (in $\mu g/m^2$-s) if it was not 1 $\mu g/m^2$-s. For example, if you ran your dispersion model using an emission rate of 1E−6 $\mu g/m^2$-s, then you would need to divide all your dispersion factors by 1E−6 to normalize them to a concentration of 1 $\mu g/m^2$-s.

C. Enter Source and Justification for User-Specified Dispersion Factors (Screen 5B)

The program will prompt you to provide justification for user-specified dispersion data and documentation of the estimation method applied. It is important to provide this documentation as a reference that will allow you or another user to view and understand saved files at a later date.

Done. Once you have entered dispersion data, click on the |DONE| button to open the RESULTS tab. Proceed to Section 4.6, *Results*.

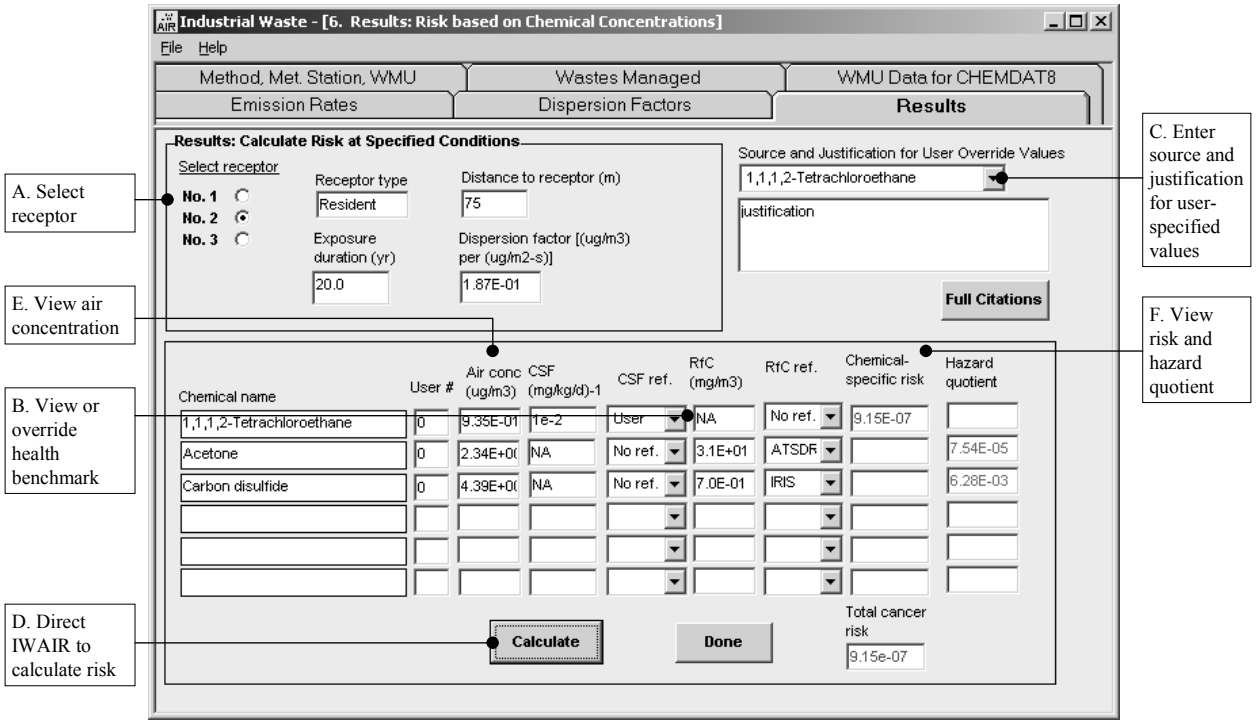
4.6 Risk Results (Screen 6)

The cancer and noncancer risk estimates attributable to emissions from a WMU can be calculated for residents and workers using IWAIR. The program combines the constituent's air concentration with receptor exposure factors and toxicity benchmarks to calculate the risk from concentrations managed in the unit. For each receptor, IWAIR calculates air concentrations using emission and dispersion data specified or calculated in previous screens. To reflect exposure that would occur in a lifetime (i.e., from childhood through adulthood), the model applies a time-weighted-average approach. This approach considers exposure that would occur during five different phases of life (i.e., Child < 1 year, Child 1–5 yrs, Child 6–11 yrs, Child 12–18 yrs, and Adult). The exposure factors addressed as part of this approach include inhalation rate, body weight, exposure duration, and exposure frequency. Default values applied

[6] An exception to this is that the exposure duration for land application units is 7.2 years for workers and 30 years for residents regardless of the operating life entered for the unit. This allows IWAIR to account for postclosure exposures, which are assumed to occur with land application units but not with other units.

by IWAIR were identified based on data presented in EPA's *Exposure Factors Handbook* (U.S. EPA, 1997a) and represent average exposure conditions. IWAIR incorporates standard toxicity benchmarks (CSFs for carcinogens and RfCs for noncarcinogens) for 95 constituents. These health benchmarks were obtained primarily from EPA's IRIS and the HEAST (U.S. EPA, 2001, 1997b). IWAIR uses these data to perform a risk calculation. See the *IWAIR Technical Background Document* for documentation of the equations.

Please note that all calculated values on the RESULTS screen will be lost if you return to a previous screen and make changes.



Screen 6. Risk Results

A. Select Receptor (Screen 6)

Select a single receptor to serve as the focal exposure point for the calculations by clicking on the option button associated with the receptor of choice. As discussed above under Section 4.5, you can specify up to five receptors for consideration. However, results can only be seen on the screen for one receptor at a time. Once results are calculated and displayed for the receptor of choice, you can select a different receptor by clicking on one of the other receptor option buttons. You do not need to enter exposure duration—this is set by IWAIR and will be displayed when you click on the |CALCULATE| button.

B. View or Override Health Benchmarks (Screen 6)

Screen 6 allows you to view the health benchmarks that IWAIR will use in calculating risk estimates. For each benchmark, the table on the RESULTS screen shows the value and a brief reference. To see more-complete citations, click on the |FULL CITATIONS| button in the SOURCE AND JUSTIFICATION box in the upper right corner of the screen.

IWAIR gives you the option of entering your own health benchmarks. If you choose not to use the IWAIR data, you can enter alternative health benchmarks by opening the drop-down box in the RFC REF. column of the desired health benchmark and selecting USER-DEFINED, and then entering a value in the text box for the benchmark. Enter CSFs (per mg/kg-d) in text boxes located under the CSF heading and RfCs (mg/m^3) under the RFC heading. Do not use a reference *dose* in the place of a reference *concentration*. Once you have entered alternative benchmarks, they are available in future runs, and you may toggle between them and the IWAIR values using the drop-down reference box.

You must enter a user-defined health benchmark for two chemicals in IWAIR's chemical database: divalent mercury and 3,4-dimethylphenol. At the time IWAIR was released, no accepted health benchmarks were available for these chemicals from the hierarchy of sources used to populate the IWAIR health benchmark database, nor were there data available from these sources to allow the development of a health benchmark with any confidence. Thus, if you want to model one of these chemicals, you will have to enter at least one user-defined health benchmark. See Section 5 of the *IWAIR Technical Background Document* for further discussion of how health benchmarks were developed for IWAIR.

C. Enter Source and Justification for User-Specified Values (Screen 6)

If you choose to override the IWAIR-provided benchmarks, you should specify the source and the justification of the alternative data in the text box. It is important to provide this documentation as a reference that will allow you or another user to view and understand saved files at a later date.

D. Direct IWAIR to Calculate Risk (Screen 6)

Click on the |CALCULATE| button to calculate exposure duration, air concentration, risk, and HQ for each chemical.

E. View Air Concentration (Screen 6)

Air concentration at the selected receptor point is displayed for each chemical identified as managed. For land application units, IWAIR calculates three different air concentrations, based on three different underlying emission rates: a 30-year average for residents for carcinogens, a 7-year average for workers for carcinogens, and a 1-year maximum for residents or workers exposed to noncarcinogens. Depending on the receptor selected and the chemical, IWAIR displays the appropriate air concentration. However, for chemicals that are both carcinogens and noncarcinogens, only the 30- or 7-year average used for the carcinogenic risk

calculation is displayed. To calculate the 1-year maximum used in the noncarcinogenic HQ calculation, multiply the emission rate shown on the EMISSION RATES screen by the dispersion factor, and then multiply by 1,000,000 (to convert units).

F. View Risk and Hazard Quotient (Screen 6)

Cancer risk estimates and HQs (both unitless), respectively, are displayed for each carcinogen and noncarcinogen identified as being managed. IWAIR calculates lifetime excess individual cancer risk. This is the probability that an individual exposed at the specified level, under the specified exposure assumptions, will consequently contract cancer during his or her lifetime. Although the risk is unitless, it reflects probability. Thus, a risk of 1E−5 means that an individual has 1 chance in 100,000 of contracting cancer as a result of exposure.

For noncarcinogens, the HQ is a ratio of the air concentration to which an individual is exposed, to the RfC. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is unlikely to pose an appreciable risk of deleterious noncancer effects during an individual's lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfC, the potential for adverse health effects increases; however, lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur.

In addition, a total cancer risk estimate, which is the sum of the chemical-specific risk estimates, is displayed. No total noncancer risk is calculated because noncancer risks are appropriately summed only when the same target organ is affected.

Done. Click the |DONE| button to initiate a new run or save the run that you have just completed. A dialog box will appear to guide you through starting a new run or saving the current run.